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CHINA REPORT

SCIENCE AND TECHNOLOGY

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PEOPLE'S REPUBLIC OF CHINA

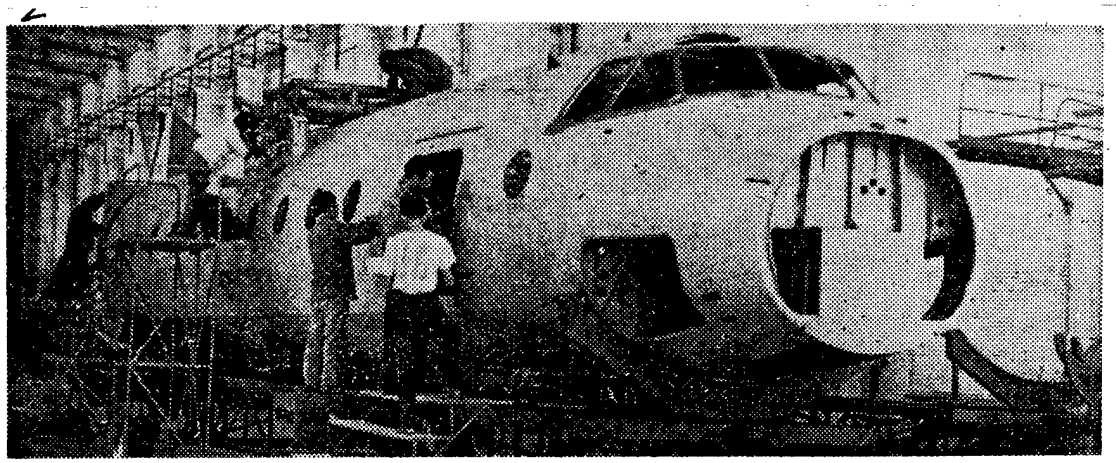
ABSTRACTS

APPLIED SCIENCES

XI'AN AIRCRAFT PLANT TURNS OUT NEW 'Y-7' TRANSPORT

Xi'an SHAANXI RIBAO in Chinese 21 Aug 82 p 1

[Photograph caption]



With the approval of the State Council and the Central Military Commission, batch production of the "Y-7" transport aircraft is now underway. Shown in the protograph are personnel of the Xi'an Aircraft Manufacturing Company working on the fuselage assembly.

CSO: 4008/225

A SURVEY OF FUSION REACTOR DESIGN STUDIES

Chongging HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese, Vol 1, No 1, 1981, pp 1-10

[Article by Huang Jinhua [7806 6930 5478] and Deng Poquan [6772 2672 2938]: "Description of Fusion Reactor Design and Research"]

[Text] The first part of this article describes some of the physical, structural, heat release and environmental safety characteristics of fusion reactors by comparing them with fission reactors. The second part discusses the content and progress in fusion reactor design and research and problems in reactor plasma physics, heat release, maintenance and repairs.

It is expected that the realization of controlled fusion will have to demonstrate its scientific feasibility, engineering feasibility, technical feasibility, economic feasibility, environmental safety and its feasibility for commercialization.

In recent years, experiments in plasmas have realized encouraging progress. International research and planning are still in a stage of demonstrating their scientific feasibility. But the topics of engineering feasibility and technical feasibility had already begun at the end of the 1960s. Conceptual design of the fusion reactor has realized a lot of progress. Economic and environmental problems have also been considered and such consideration has deepened.

I. Some Characteristics of the Fusion Reactor

In nuclear reactions, the fusion reactor can be divided into two parts, the core and the envelope. In the core, the energy released by fusion is mainly brought out by fast neutrons of 14.1 mega-electron volts. In the envelope, the energy of the neutrons deposits and produces tritium or fission fuel. This can solve the long-term needs for energy, and the fusion reactor has many characteristics when compared to the fission reactor:

1. Neutrons are abundant. The energy from one nuclear fusion reaction is smaller than that from a fission reaction by one magnitude. With the same

power, the reactivity in the fusion reactor is much larger. The number of neutrons provided in addition to those needed to maintain themselves per unit time interval is about 10 times larger than the fast neutron breeder reactor. The time for fuel multiplication is about 1/10 that of the fast neutron reactor.

2. Fusion and neutron reactions (energy deposition and capture absorption) occur separately in the core and the envelope. The power density in the envelope is low and uneven.

The neutron flux rapidly drops as the neutrons move further away from the neutron source in the core. The power density on the first wall facing the plasma is the greatest. The load on the neutron wall is defined as:

$(P_w)_n$ = fusion neutron stream Jx14.1 mega-electron-volts, megawatt/square meters. The main purpose of studying fusion reactor materials is to develop materials that can reach a higher megawatt-year/square meter value. Because it is difficult to maintain and replace the parts in a fusion reactor (especially the tokamak reactor), the useful life of the first wall must not be too short. This limits $(P_w)_n$, thus the power density in the envelope is low (See Table 1).

The above characteristics form some of the differences between a fusion reactor and a fission reactor.

(1) The building cost of a fusion reactor is high, but visible progress in the improvement of the economic performance in design and research has been realized (See Table 2). The building cost of the reactor is far greater than that of the fission reactor, but it does not constitute a major portion of total construction cost.

Table 1. Thermal Engineering Parameters of Various Types of Reactors.

	Average power density in core watt/cubic centimeter	Maximum surface heat load watt/square centimeter
High temperature air cooled reactor	8.4	58
Air cooled fast reactor	240	184
Sodium cooled fast reactor	360	259
Pressurized water reactor	100	176
Fusion EPR	5	23

For the fusion reactor, the values are those of the envelope.

Table 2. Capital Construction Cost U$$/kilowatt [1]

	Reactor system	Rest of power station
Fusion reactor UWMAK-1, 1,500 megawatts of electricity (designed in 1974)	1000	800
ORNL/DEMO design, 750 megawatts of electricity (1977)	450	800
Sodium cooled fast reactor, 1,200 megawatts of electricity	100	700
Pressurized water reactor, 1,000 megawatts of electricity	75	525

(2) The exit temperature of the coolant can be very high. The temperature of the structural material of heat releasing components inside the reactor Tw is determined by the temperature Tc of the coolant at that locality, the heat load q and the coefficient of convection heat conduction h, i.e.:

$$Tw - Tc+q/h$$

The allowable operating temperature of the material limits the temperature the coolant can reach. Because the distribution of q is very uneven, a low temperature coolant can be used first to cool the first wall which has a high q value. Then the coolant can be allowed to flow towards the region where the value of q drops and where a higher Tw is allowed (because the intensity of neutron radiation also drops), thus realizing a high exit temperature. It is hopeful that this can be used to produce synthetic fuel and to generate electricity from magnetic fluid.

(3) Fission fuel ^{239}Pu and ^{233}U can be produced in a versatile manner in one reactor.

3. Environmental and safety problems. In fusion reactor accidents, spilling of liquefied metals may occur, the magnet may malfunction, the power and the flow of coolant may be imbalanced, and plasma confinement may be destroyed.

Because the relative harmfulness of radioactivity from fission products and the actinium group elements formed by heavy nuclear transmutation is high and the half life is very long, the relative harmfulness of radioactivity of the fission reactor is estimated to be several magnitudes higher than that of the fusion reactor, and the safe storage of radioactive waste of a long life also needs to be solved well. Because critical nuclear accidents will not occur in the fusion reactor, because the power density is lower, and because the power is also low after reactor shutdown, people commonly believe that fusion reactor accidents are less dangerous. The daily leakage of radioactivity of both are about the same. The fusion reactor mainly leaks tritium. Molecular tritium actually does not dissolve in human tissue. People directly exhale 98 percent of the tritium inhaled. It is relatively harmless but tritium liquid is more harmful. The quantity of solid radioactive waste produced by a fusion reactor (mainly replaced parts) is large, and it cannot be treated by concentration.

4. The structure of the tokamak fusion reactor is complex and maintenance is difficult. This is mainly because of its ring geometry, the small ring-radius ratio R/a, the chaining of the coils of the ring field and the polar field, the high degree of vacuum created by hermetic welding, the large numbers of entry and exit pipes for the coolant, and the large facilities surrounding the reactor such as the neutral injector, etc. During maintenance, remote operating facilities are used. The vacuum welded seams are cut open via tubes that are not too large, and the joints of the coolant pipes are dismantled. The parts that need to be replaced are taken out. It may require more than 100 days from the time maintenance begins to the time the reactor is restored to its original operating status.

5. Intermittency. The tokamak plasma current is produced by induction. At present, it can only be sustained for a period of time. Also, there is the problem of accumulation of impurities in the plasma and operation is intermittent. However, the production and output of electric energy can be stable. This can be maintained by storing some high temperature coolant in the circuit or by simply utilizing the thermal capacity of the coolant itself. How to maintain stability of the tokamak or realize long operating pulses is an important question in reactor research.

6. The general course of development of reactors is to build an experimental reactor (ETR), an experimental propulsion reactor (EPR) of several dozen megawatts in scale, commercial demonstration reactors of about 200 megawatts of electric power (DEMO), and then a commercial reactor. Such fission reactors have very different dimensions, therefore the building costs are also very different. The dimensions of the different stages of fusion reactors are almost the same. The larger the experimental fusion device, the smaller the designed dimensions of the reactor as shown in Figure 1 [2]. Design research shows that the dimensions and the building cost of reactors ranging from several dozen watts to 1,000 megawatts of

electricity are about the same. The fusion reactor regulates the total power via the load on the neutron wall.

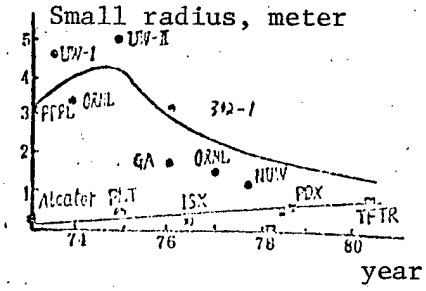


Figure 1. Developmental trend of the size of fusion devices

II. Design Research of a Fusion Reactor

1. Conceptual Design and System Research for a Fusion Reactor

From the end of the 1960s, people began broad and in-depth studies of the fusion reactor. It seems that the commercial reactor that was finally build will not encounter any unsurmountable difficulties, but undoubtedly, a lot of manpower and materials and a long time (for example, about 30 years) will have to be invested before this can be realized. Reactor research can generally be divided into two closely related aspects: design research of the reactor power station (including systems research) and special technology research. Special technology research includes superconductive magnets, materials and tritium. Through design research, several dozen conceptual designs have been proposed for the reactors of each step based on various types of magnetic confinement configurations and laser fusion. After efforts in design and computation by specialized personnel in various fields, and after mutual coordination, designs from the parameters of the plasma to the structural draft and the general layout can provide as completely as possible a basis for a general view, performance and design as well as economic analysis and environmental safety analysis. Such a complex facility that combines many technologies has many problems that need to be solved. For this, many hypotheses have to be introduced into the design, for example, the selection of criteria for the coefficients of plasma transport, the selection of various computational formulas and parameters needed in the design, the hypothesis that remote vacuum sealed welding operations can be realized, etc. Many factors have to be gradually determined in reactor technology research. Therefore, technological research subjects and the range of parameters in research can be found in conceptual designs. Progress in reactor technology research will also change conceptual designs. Through mutual stimulation, the goal of building the reactor can be realized.

The purpose of the conceptual design of a reactor is not to provide a design for a reactor that is about to be built. It is to investigate clearly which technological problems have to be solved and the relative importance of these problems, and to propose a design plan that will solve the problems and thus help form and implement research planning for fusion reactors. Conceptual designs can serve as a reference used to measure the effect of new technological data and new ideas on the performance of the reactor. It provides a foundation for systems research.

Systems research of a reactor involves a comparative evaluation of different design concepts and selections. Economic factors (such as the price of electricity) are used as the quality factors for comparison and optimization. This requires the establishment of a model that describes every part and a computational program that describes the entirety of the power station on this foundation. The computational results show changes in the performance of the power station and its economic data along with certain key factors.

Since the 1970s, reactor design work has made relatively great progress. This is mainly because the scale of reactors has been reduced, their economic properties and maintainability have improved, their technological requirements have been reduced, many designs of various types of reactors have been proposed, and analysis has delved into such questions as their economic properties, safety and environmental impact.

As a rough estimate,

the total building cost of a reactor system $\propto$ size of the reactor structure $\propto$ (radius a of the plasma)^2 x total thickness of the envelope Δ ,

$$\text{Building Cost per unit electric power of the reactor} \propto \frac{\text{size of reactor structure}}{\text{power of reactor}} \propto \frac{\Delta}{P_v a} \propto \frac{\Delta}{P_w} \qquad (2)$$

Δ includes the thickness of the envelope, the shield and the magnet; P is the average power density of the plasma. Increasing the load on the wall Pw can reduce the building cost per unit electric power of the reactor. Under a fixed Pw, increasing Pv can reduce a and thus reduce the building cost of the reactor system, and at the same time, the scale of the reactor can be reduced (dimension and total power). This is very meaningful. The scale of previous designs was large and engineering and technical problems were difficult. Figure 2 [3] and Table 3 show some visible differences in tokamak designs of the past several years. Because $P_V \propto n^2$, $P_W \propto an^2$, $n\tau \propto n^2 a^2$, it is beneficial to increase the plasma density n, which is limited by the allowable β value. Increasing the value of β is a goal of research in plasma physics. This requires reducing the ring-radius ratio A, the safety factor q, and increasing the allowable polar β value.

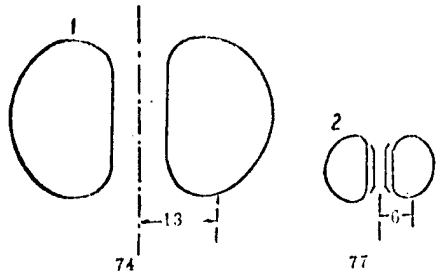


Figure 2 . Change in the scale of Tokamak designs

1. a=5 meters; Pw=1 megawatt/square meter; P=1,700 megawatts of electricity.

2. a=1.5 meters; Pw=5 megawatts/square meters; P=750 megawatts of electricity.

Table 3. Changes in the scale of Tokamak designs

	UWMAK-1 of 1974	After 1977
Large radius of plasma	13 meters	5-6
Small radius of plasma	5 meters	1.2-1.5
Dimensions of magnet	15x22 meters	3.5x8
Pw	1 megawatt/square meter	2-5

Simplifying equations (1) and (2) gives a rough estimate, and more factors must be considered. For example, increasing Pw requires the use of a strong and more costly magnetic field, and replacement of the first wall will be more frequent. Also, for example, under a fixed Pw, increasing the β value to reduce the strength of the magnetic field needed can reduce building

cost but as the cost of construction of the coils of the magnetic field as a percentage of the total construction cost drops, the benefits from an increased β become less obvious. Systems research in GA gives us Figures 3, 4 [4]. The conclusion is that the Pw of the non-circular section reactor considered for GA can be taken as 2 megawatts/square meter, and β should be (10-20) percent. This is an example of systems research work.

The maintainability of the tokamak reactor has been greatly improved. The vacuum wall is moved outward from the position of the first wall. For example, moving it to the outer surface of the shield can simplify maintenance work. The number of coils of the main magnetic field is lessened to the number allowed by the degree of rippling. The polar field coil is placed on the outside of the coils of the main magnetic field as much as possible.

Technological requirements have been lowered. For example, research by ORNL has proposed the use of microwave to preheat electrons and this may lower the ring voltage needed by one magnitude. Consideration has been given to the mechanism of fuel dispersion. The required depth of penetration of pellet feed can be greatly reduced. Because of heating of a particles at the center of the plasma is concentrated, heating by a neutral beam may not have to penetrate the highly dense region. In this way, the required beam energy can be greatly reduced.

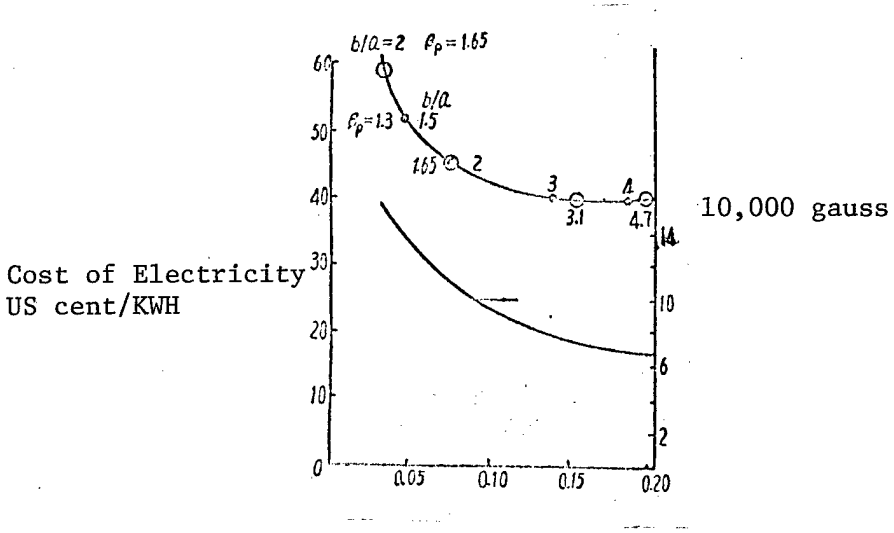


Figure 3. Change in the price of electricity with β values

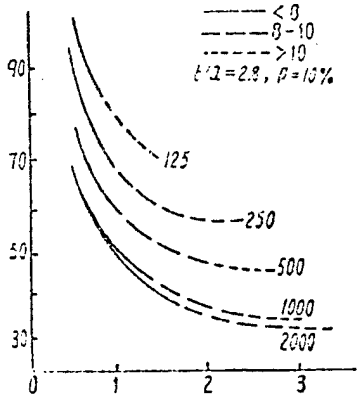


Diagram 4. Changes in price of electricity along with load of wall and total power

2. Some Questions in Plasma Physics in the Operation of a Fusion Reactor.

(1) The problem of startup [5-8]. Startup includes ionization and excitation of electric current. The rise in current finally establishes the specified operating current and appropriate use of auxiliary heating produces ignition. In view of present experiments, several hundred volts of ring voltage are required to overcome bremsstrahlung of small amounts of light impurities (such as oxygen) and blocking of linear radiation. Under reactor conditions, the pulse current density allowable by the technology of the superconductive ohm heating transformer limits the ring voltage to reach only about 50 volts. Although we can use low density startup to reduce the n^2 term of loss, the problem of escaping electrons exists. If the electrical field is too weak, discharge heating will not be fast enough, and because of loss due to dispersion by the resistor, a part of the volt-second count will be lost, therefore it is expected that in the future, several dozen megawatts of radio frequency power must be supplemented at the beginning of discharge so that the lowest electrical field required to produce an avalanche of electrons can be realized. For a discharge of a limited q value, the maximum ohn heating power $\propto (B\tau/R)^2$. The larger the large radius R, the poorer the ohm heating effect. The electron temperature and the electrical current cannot be quickly established. Perhaps, a low power radio frequency heating has to be added at the beginning of startup. This is estimated to be about the same magnitude as the ohm heating power. But, it cannot be too large, otherwise the skin effect will become serious.

Within the dimensions of the reactor, the skin effect will influence the current density and cause it to rise at the center because the electromagnetic field requires a fixed time to penetrate the center of the plasma. Therefore, the small radius must be smaller at the beginning of discharge, then a moveable aperture can be used following a definite procedure to allow a and the intensity of the total current to increase simultaneously. But if a is too small at the beginning moment, injecting more gas may possibly cause the loss to surpass the Murakami limit

$$n_c < 1.5 \times 10^{20} B_\phi \text{ (10,000 gauss)} / (qR(\text{meter}) Z_{eff}) \quad \text{meter}^{-3}$$

and thus bring about a break in the discharge. The initial intensity level of the neutral gas greatly affects the development of discharge. The minimum ionization time measured by A. Buffa et al was done under a pressure of 5×10^{-5} torr in the filling gas. This is most favorable to producing an avalanche of electrons.

The problem of using auxiliary heating to reach ignition and controlling the distribution of combustion: High power neutral injection and radio frequency heating are considered the most promising means of auxiliary heating in a reactor at present. But, the neutral beam based on the positive ion source used at present has become unfavorable in reactor conditions because the injection power achieved in a unit volume of plasma will unavoidably weaken along with increases in the volume and density of the plasma. This is because

(a) the ratio of the surface area of the plasma Σ_p and the volume of the plasma V_p is $\Sigma_p / V_p \propto 1/a$;

(b) to avoid heating only the neighborhood of the surface, the center of the reactor level plasma typically of a density of 10^{14} centimeters $^{-3}$ and a radius of 1 to 2 meters must be penetrated. The energy of the beam (deuterium) particles must at least be larger than 200 kilo-electron volts. The efficiency of neutralization of the beam of positive ions within such a high energy range is greatly reduced (the section of neutralization reduces), see Figure 5. It can be approximately represented as

$$\eta(E) = \left[1.0 + 3.0\left(\lg \frac{E}{4 \times 10^4}\right)^{10}\right] \times 10^{-0.673(\lg E - 4.3)^3} - 0.046$$

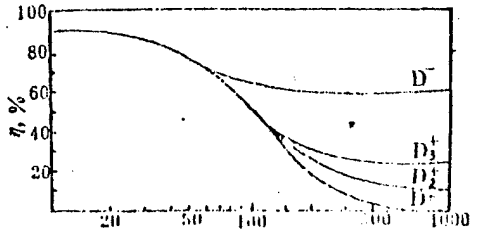
(E>10 kilo-electronvolts)

For example, in present experiments, E=70 kilo-electron volts, $\eta \approx$ 70 percent, and under reactor conditions, E=200 kilo-electron volts, and $\eta \approx$ 18 percent.

The power that can be injected into a unit volume of plasma is

$$P_{inj} = (2/a\kappa) \cdot \sqrt{(1+\kappa^2)/2} \cdot C_p \cdot j_b \cdot E \cdot \eta(E)$$

where E is the beam energy; η (E) is the efficiency of neutralization; C_p is the ratio between the area of the whole injection window and the surface area of the plasma; j_b is the current density of the beam. It is limited by the limits of the spatial electric charge, $j_b \leq 2.7 \times 10^3$ amperes/square meter; κ is the ellipticity. For the reactor, the radius of the plasma a is larger, thus the way to increase P_{inj} is to increase η (E). Therefore, we need to develop a source of negative ions. Its efficiency of neutralization within this energy range can still reach 65 percent. Another possible way is low density startup. Only 150 kilo-electron volts are required for penetration, then the density can gradually accumulate. When ignition occurs, the power produced by fusion will mainly be concentrated at the center, and a very high beam energy will not be necessary for penetration into the neutral region.



A. Energy of the beam particles, kilo-electron-volt

Figure 5. Change in neutralization efficiency along with changes in the energy of the deuterium beam particles.

The heating efficiency of radio frequency is higher. Radio frequency heating has a better spatial versatility and it does not require a very large opening. This is favorable to satisfying thermal stability requirements in controlling the temperature distribution on the section and in controlling combustion.

(2) The problem of instability of combustion heat and its control. It is always hoped that before ignition of a reactor, plasma confinement can be maintained well as much as possible so that auxiliary heating will be more economical. But when the temperature surpasses ignition, some common concepts are reversed. At this time, if energy confinement and particle confinement are too long, they will possibly lead to the development of thermal instability. If Alcator calibration is still maintained after ignition, the control of combustion will encounter definite difficulties. This is equivalent to the presence of a positive temperature coefficient. Disturbance of temperature by combustion is unstable. We must think of a

way to regulate the rate of loss in plasma transport or the rate of thermonuclear reaction from the outside. The preliminary ideas are: (a) Reduce the evenness of the ring field to strengthen ripple dispersion, this means reducing the number of coils in the ring field and adding some compensatory coils that can be regulated in a versatile manner so that the degree of rippling in the ring field can be appropriately regulated. (b) Theory predicts that when the temperature of the plasma rises and surpasses β_{max}, nonlinear turbulence will occur and it may possibly lead to a kind of mechanism that will automatically regulate the rate of energy loss. (c) We can regulate the ratio between the rate of feeding and mixing under our control and thus regulate the rate of thermonuclear reaction.

(3) On the control of impurities and the removal of residual ash. Experiments show that the polar-bias filter is effective. But it will also lower the combustion rate and in particular, there are many engineering and technological difficulties. Another thought is to introduce a cold plasma shield, but whether this configuration can exist stably involves the question of balance of various kinds of flow.

(4) The question of feed [9] A fusion reactor requires additives to supplement internal fuel consumption of the reactor plasma. For example, when it operates at a density of 2×10^{14} centimeters $^{-3}$, it is estimated that the supply of fuel required will be 4 grams/megawatt day. Then, for a reactor with a thermal power of 3,000 megawatts, the rate of feed will be 12 kilograms/day. This requires from a dozen or so to several hundred independent injectors. Among the feeding plans currently being studied, injection of pellet feed has been studied the most. Pellets are generally crystals of $A>10^9$ amu with a diameter >5000Å. The advantage of pellet feed is that the fuel can be deposited in the central area of the plasma. The following series of questions must be answered in theory and experiments: (a) How are the pellets manufactured? (b) What is the life and the rate of evaporation of the pellets in the fusion plasma environment? (c) What will be the effect of the introduction of pellets upon the plasma? (d) What velocity can the pellets be accelerated to? What method can be used?

P.D. Parks et al started out from the neutral melting model and took into consideration the shielding effect and derived the rate of evaporation of pellets expressed in the following formula

$$dr_p/dt = -1.58\times10^{-8} r_p^{-2/3}(\text{cm}) n_{eo}^{1/3}(\text{cm}^{-3}) T_{eo}^{1.64}\ (\text{electronvolt})\ \text{cm/second}$$

where r_p is the radius of a pellet; n_{eo}, T_{eo} are respectively the electron density and the electron temperature in the plasma. It coincides well with experimental data. Experiments showed that the introduction of pellets did not cause visible energy loss in the plasma and the density increased several times. Such feed is effective.

(5) The problem of stable operation. There are several ideas on extending the plasma current of the tokamak reactor to produce long pulses or to realize stable operation: (a) using neutral beam injection to provide movement to produce the plasma current and at the same time to partially supplement fuel; (b) using radio frequency for heating and relying on the movement of microwave radiation to drive the plasma current; (c) using escaping electrons to provide the plasma current because their frictional resistance of coulomb collision in the plasma is very small, i.e., they have a very low plasma electrical resistance and it is hoped that they can extend the time of attenuation of the current.

3. Problem of Heat Conduction in a Fusion Reactor

(1) The envelope. The envelope (especially the first wall) is closest to the plasma. High temperature and strong radiation may cause a greater degeneration of thermal and mechanical properties of the materials. In the pulse type reactor, fluctuation in temperature of the materials is also great and this will cause serious fatigue problems. The temperature gradient here is also large and it should be reduced in design.

Because of the ring geometry of a small ring-radius ratio, positioning the cooling pipes in the tokamak reactor is more difficult. Problems in designing the heat dissipation system of the envelope and the envelope modules and maintaining performance are combined to become a key problem in design. This constitutes one of the characteristics differentiating various conceptual designs.

(2) The protective layer of the first wall. To reduce the burden of the first wall and to reduce the effects of impurities, the design frequently uses wall curtains made of C or SiC. These materials that are tolerant to high temperatures allow radiation to pass through and transmit heat, but we must prevent the temperature from rising too high and cause sublimation or the occurrence of chemical reactions with hydrogen isotopes. The temperature difference between the materials connected by the high temperature protective layer is large and this problem must be solved well. The protective layer can reduce the amplitude of fluctuation of temperature on the first wall as shown in Diagram 7 [10] and thus ease material fatique.

(3) The bias filter's gathering wall. It is bombarded by charged particles from the bias filter. This part of the energy flow is very different in different designs. The heat load on the wall may be very large, causing difficulty in heat dissipation.

(4) Superconductive magnet. Its temperature has to be maintained below the critical temperature. In the tokamak reactor, the energy stored in the coils of the main magnetic field can reach 10^5 megajoules. In low temperatures, the specific heat of the materials is almost zero. This means that a small heat fluctuation will cause a large temperature fluctuation, and we need to take stabilizing measures to guarantee safety when local loss of

superconductivity occurs. The magnet must be cooled. When the temperature is very low, such as at 4 ^{o} K, the deposited heat must be released and this uses a lot of energy. For example, the release of 0.2 megawatts of power uses about 80 megawatts. Therefore, the magnet needs sufficient shielding.

Besides the loss of superconductivity by the superconductor, a breakdown of the cooling pump, a short circuit or a break in the circuit, puncture of insulation will all cause an accident in the magnet. At this time, the problem of transferring a very large amount of energy stored in the magnetic field must be handled well.

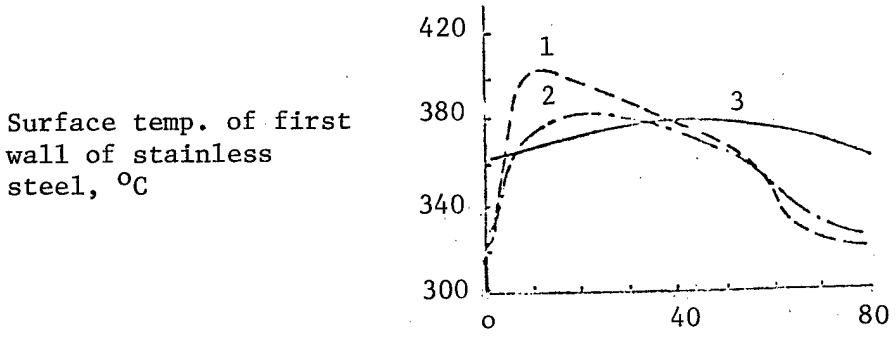


Figure 6. Temperature fluctuation on the first wall in the cycle when the protective layer reduces

1. Exposed wall; 2. Coverage of the graphite limitator 10 ; 3. C lining;

4. Maintenance of a Tokamak Reactor

The first generation fusion fuel is deuterium-tritium. The reaction produces neutrons. This necessitates remote operations for maintenance of the reactor. The shutdown time of the reactor for maintenance is determined by accessibility of the parts that need maintenance or replacement and the maintenance equipment available for use and it directly affects the economic nature of commercial reactors and time utilization. Accessibility is an important property of the fusion reactor. It is related to the characteristics of the design of the envelope, the number of coils of the main magnetic field, the number of coils of the polar field and the arrangement of peripheral equipment of the reactor.

There are several choices for positioning the wall of the vacuum chamber as illustrated in Figure 7. The secondary vacuum wall allows penetration at a low rate of gas leakage. It can lower the required capacity of the main vacuum pump.

The efforts of [11,12] gave a detailed comparison of several typical reactors. The important points related to maintenance are listed in Table 4, and referring to Figures 8-10, the comparative studies provided computational results shown in Figure 11 and Table 5.

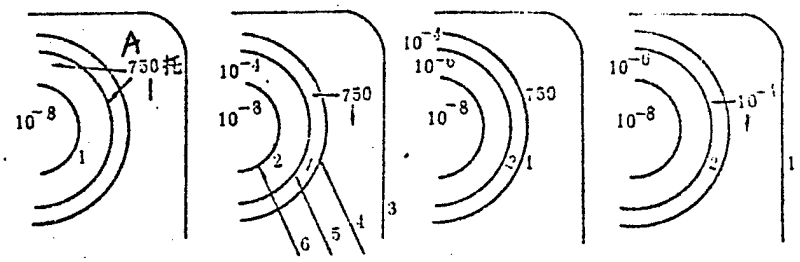


Figure 7. Position of the wall of the vacuum chamber

1. Main vacuum wall; 2. Secondary vacuum wall; 3. Reactor chamber; 4. Supporting panel on the side; 5. Exterior of the shield; 6. Front end of the envelope module. A. 750 torr.

Table 4. Characteristics of replacing designed modules of several reactors

---

1. Type of module
2. Large replacement module
3. Medium
4. Small
5. Design
6. Item
7. Thermal power, megawatt
8. Number of coils of main magnetic field
9. Number of modules
10. Weight of module, ton
11. A type 50 tons, B type and bias filter 8 tons
12. 380 kilograms
13. Size, meter

14. 0.7 diameterx0.36

15. Length 7-16

16. Removal of the module

17. Entire fan section (with the TF coil) is moved to the heat chamber by a special large cart running along tracks.

18. The outer shielding door is opened and the fan section (not including the cork shaped module of the bias filter) is moved out radially while the TF coil is not moved.

19. The outer shielding door is opened at top and bottom and module A is taken out, then the other modules are taken out.

20. The top vacuum hole is opened, the remote operating equipment is inserted into the plasma chamber from here and the modules are replaced inside the chamber.

21. Cassette type modules are removed from between the TF gaps, the modules along the radial direction of the small ring are separated into three layers, those in the inner layer are replaced most frequently.

22. Position of the main vacuum chamber

23. Front end of module

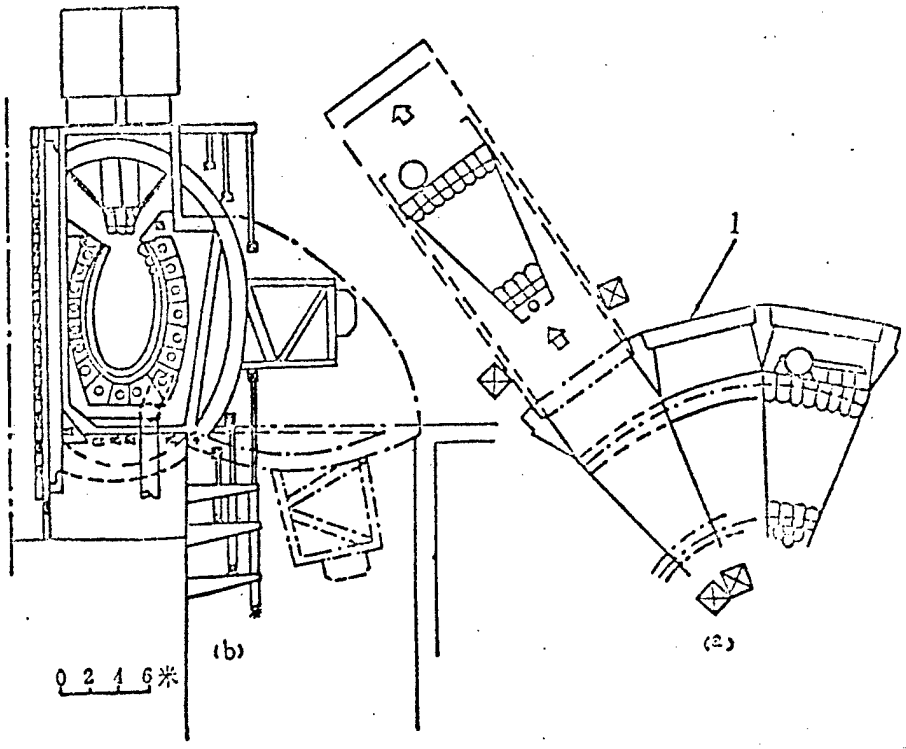
24. Outer shield

25. Back end of module

26. Back end of module

27. Wall of the hermetic chamber of the reactor

1 模件类型	2 大型更换模件		3 中型	4 小型	
5 设计 / 6 项目	UWMAK-I	Culham I	UWMAK-I	GA-DPR	ORNL
7 热功率，兆瓦	5000	5000	5000	1761	3650
8 主要扇形区数	12	12	18	16	18
9 模件个数	12	12	90	2000	810
10 模件重，吨	3500	800	11 A型50吨，B型和C型各8吨	12 380公斤	3—5
13 大小，米	26×18×12	16×10×6		14 0.7直径×0.36	15 长7—16
16 模件的取出	17 整个扇形段（连同TF线圈）由特制的大极车沿轨道移至热室	18 移开外屏蔽门，将扇形段（不包括偏压滤波器软木形模件）径向移出，TF线圈不动	19 上下打开外屏蔽门，取出模件A，然后是其他模件	20 打开上部真空孔，远距离操作设备从这里插入等离子体室，在室内更换模件	21 整个模件从TF线圈间取出，小环径向分三层，内层更换最多
22 主真空室位置	23 模件前端	24 外屏蔽	25 模件后端	26 模件后端	27 热室的壁



1. Outer shielding door

0 2 4 6 meters

Figure 8. Illustration of the Culham-II structure

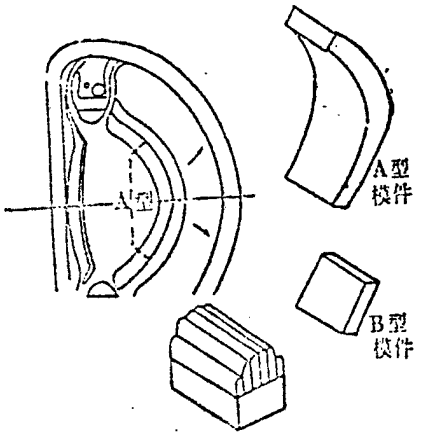


Figure 9. Illustration of the structure of UWMAK-III
A type, A type module, B type module

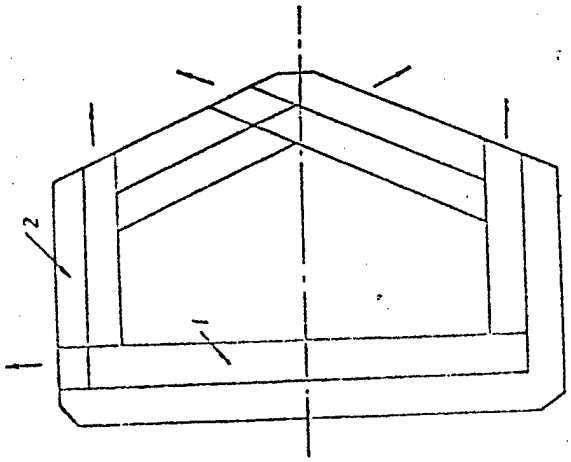


Figure 10. Illustration of the structure of the ORNL envelope layer 1. Moveable envelope layer module; 2. Fixed shielding layer.

Table 5. Data related to the designed maintenance of several reactors

1. Design
2. Item
3. Proportion of the whole reactor during each replacement
4. Number of days needed for maintenance
5. Maintenance intervals, day
6. Time utilization rate,
7. Number of days needed for unscheduled maintenance
8. UWMAK-I, 5000 megawatts
9. UWMAK-I, 3000 megawatts

1 设计 \ 2 项目	3	4	5	6	7
8 UWMAK-I，5000兆瓦	4/12	154	706	66	
9 UWMAK-I，3000兆瓦	4/12	134	~800	69	
Culham-I	4/12	47	372	74	17
UWMAK-I	13/18	111	957	73	44
GA	660/2000	214	930	64	
GA*	400/2000	53	474	76	7
ORNL	6/18		~350	72	31

*Using 8 remote maintenance units operating simultaneously.

* 采用8台远距离维修机同时操作。

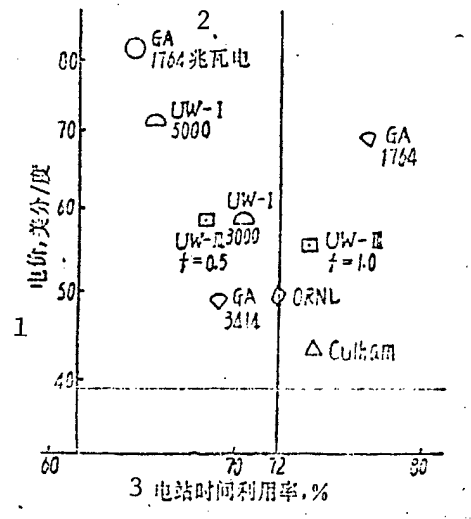


Figure 11. The price of electricity of the power station and time utilization rate

1. Price of electricity, US$ cents/kilowatt-hour

2. 1764 megawatts of electricity

3. Time utilization rate of power station, %

The goal of a time utilization rate of 72 percent in Figure 11 is feasible for the fission reactor power station. The target for the price of electricity is the expected data for the coal-fired power station in the year 2000.

The conclusion is that (a) based on such a design, the price of electricity will be higher than that of a thermal power station, (b) it is hopeful that the time utilization rate of reactor stations with large, medium and small modules can reach 72 percent; and (c) the number of days required for maintenance is 50 to some 100 days.

The results of comparison show that the Culham-II is more favorable to maintenance, and work on this basis [12] has proposed an improved design. The improvement mainly involves automation and combining the series of time consuming work of making a passageway. Diagram 8b shows the improved design for making a passageway. After improvement, the time to open the shielding door, the sideways supporting panel and the neutral injector required is only 13 hours. Therefore, the total amount of time needed is reduced to 300 hours. The time utilization rate of the improved design is 79.7 percent, and the price of electricity can also be reduced to below that of thermal power stations.

5. The tokamak reactor may very possibly be used for the first generation fusion power station, but it has some stubborn difficulties: the specific pressure value β is low and it requires a strong magnetic field; the structure is complex, maintenance is difficult; pulsed operation requires a system to store and transport energy, and this causes problems of fatigue in structural materials. Some other types of reactors are superior in these aspects. The design research work for these reactors are also being actively carried out.

(1) Serial Magnetic Mirrors. LLL research believes the energy gain $\underline{Q}$ of serial magnetic mirrors can reach 10. They are suitable for building mixed type reactors. In this way, the requirements for stopping leakage is reduced. The key problem to be solved is to demonstrate a high $\underline{Q}$ value, to develop of negative ion source, a 120,000 to 180,000 gauss leakage blocking magnetic field and a direct energy converter for charged particles.

(2) Mixed reactor with magnetic mirrors. Design research of this type of reactors began relatively early, and reference [13] gave a detailed introduction. We must solve the special problems of the mixed reactor and develop highly efficient direct energy converters.

(3) Creased ring (EBT). The ring-radius ratio is large, the β value is high, and it can naturally control impurities. The key is to demonstrate these advantages, and develop high power microwave heaters (of frequency of about 120 kilo-megahertz and power of about 3 to 6 megawatts).

(4) Reverse Field Packing (RFP). Its polar field approaches the ring field, therefore the β value is high, it has a medium storage requirement (<10 kilo-megajoules), its ring-radius ratio is large, and it does not need auxiliary heating. The problem that has to be solved is to acquire an understanding of the energy loss in the process of establishing the reverse field, to use low frequency feedback stabilization to replace the stabilizing function of the conductor wall; to develop large pulsed superconducting coils, to require the rate of variation of the magnetic field to reach 100,000 gauss/second.

Other reactor designs proposed include straight line packing and fast encasing sleeves. The common characteristics of the above concepts are a high β value, an open geometric shape, the possibility that the needed envelope replacement time is only several days, but some characteristics in plasma physics still need to be demonstrated, and some unique and key technical problems still remain.

There are also some detailed conceptual designs for inertia confinement. The design by LLL takes the energy gain of the laser target G $\approx$700-1,000, and the efficiency of the laser drive η_L at (2-5) percent. The drive efficiency of the relativity electron beam is high (>25 percent), but G<50. Maintenance of the inertia confinement system is good and the requirement for the vacuum system is low. The key is to demonstrate that the gain of the system $Q = \eta \times G > 50$, the energy of the drive >1 megajoule, economic production of target pellets, injection and tracking. According to estimates, by 1983, the laser device of SHIVA NOVA will be able to reach G>20 [14].

Some designs have also been made for the non-deuterium-tritium fuel reactor. It does not need tritium as fuel and radioactivity is much smaller. Because the conditions for fusion are sophisticated, they are ideas for the next generation.

Conclusion

Compared to fission reactors, fusion reactors can provide richer and safer energy with less environmental pollution. It can also produce fission fuel more rapidly and in a more versatile way. Because the power density is low, the construction cost of the reactor is higher. Progress in tokamak design research has brought about hope in satisfying the time utilization rate required by power stations, and optimistic estimates of the price of electricity hopefully may compare with that of thermal power stations. Fusion can become a competitive energy but it is estimated that the first commercial demonstration reactor will not be completed by the end of this century.

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(Article received by the Editorial Department in October, 1980)

9296
CSO: 4008/201

BRIEFS

SHANGHAI NUCLEAR MEDICINE--Shanghai, 25 Aug (XINHUA)--More than 40 hospitals here have established departments of nuclear medicine, treating about 100,000 patients a year, according to the Shanghai Municipal Public Health Bureau. Nuclear medicine utilizes radioisotopes to diagnose and treat serious diseases. Shanghai first began to practice nuclear medicine in 1958 and now the therapy is used to diagnose diseases of brain, lungs, thyroid gland, liver and kidneys as well as diseases of heart and bone. Ruijin Hospital, attached to the Shanghai No 2 medical college, has recorded an 85-percent accuracy rate using nuclear medicine to diagnose diseases of the adrenal gland, much higher than that achieved by using traditional blood-testing or x-ray methods. [Beijing XINHUA in English 0701 GMT 25 Aug 82 OW]

CSO: 4008/219

PUBLICATIONS

BRIEFS

SCIENCE ABSTRACTS JOURNAL--Beijing, 23 Aug (XINHUA)--The first issue of a new journal CHINESE SCIENCE ABSTRACTS in English, the first of its kind in China, will go on sale at the end of this month, according to the science press. The 48-page monthly edited by the press will have two editions, one covers mathematics, mechanics, physics and technological sciences and the other chemistry, life sciences and earth sciences. A spokesman of the science press said that China is now publishing several hundred periodicals on science and technology. The new journal will help foreign scientists keep in touch with China's work in science and technology and recent scientific results. The journal will be sold both in China and abroad. [Text] [OW251153 Beijing XINHUA in English 0222 GMT 23 Aug 82]

CSO: 4008/215

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TITLE: "On the Cause of Low Intensity Anomaly in Yutian During the Tangshan Earthquake"

SOURCE: Harbin DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 2, Jun 82 pp 11-25

TEXT OF ENGLISH ABSTRACT: In this paper, the average weighted shear modulus is used as an index for measuring the effect of ground soil in the study of intensity anomaly in Yutian during the 1976 Tangshan earthquake. The cause of low intensity anomaly is primarily correlated to the gound soil with higher average weighted shear modulus (20 m thick) and consisting of high percentage of coarse grain of soil. The effect of the thickness of ground soil on damage is discussed by comparing the average weighted shear modulus of various thickness of ground soil (e.g. 10 m, 20 m, and 30 m) and the damage. In addition, we calculated earthquake response of ground surface at various sites and established the correlation between characteristics of earthquake response and damage. Finally, the reliability of microzoning, using the average weighted shear modulus, is testified by the field data.

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TITLE: "Reliability of Earthquake-resistant Structures and Their Deformation Controlled Design"

SOURCE: Harbin DIZHEN GONGCHENG YU GONGCHENG ZHENDONG [EARTHQUAKE ENGINEERING AND ENGINEERING VIBRATION] in Chinese No 2, Jun 82 pp 45-55

TEXT OF ENGLISH ABSTRACT: It is pointed out in this paper that reliability of an earthquake-resistant structure cannot be properly evaluated by using the design method specified in the current seismic code. Elasto-plastic responses to earthquake of 1800 multi-story buildings are culculated from 24 accelerograms and distribution of ductility ratio of such buildings during earthquakes is given. Reliability of a structure is expressed in terms of probability value not exceeding a given bound value of ductility ratio and a design method based on the reliability

[continuation of DIZHEN GONGCHENG YU GONGCHENG ZHENDONG No 2, 1982 pp 45-55]

of structure is proposed. By this method, reliability of a structure can be computed when subjected to different intensities of earthquakes. If occurrence probability of earthquakes of given intensity in a given period is given, the overall reliability of the structure can be obtained. At last, reliability of some of the existing buildings is evaluated by the results in this paper.

6248
CSO: 4009/382

Exchange Conference

AUTHOR: None

ORG: None

TITLE: "Central South Regional Microcomputer Application Experience Exchange Conference"

SOURCE: Zhuzhou SHUKONG JISHU TONGXUN [COMMUNICATION ON NC TECHNIQUE] in Chinese No 3, 5 Aug 82 p 38

ABSTRACT: The Central South Regional Microcomputer Application Experience Exchange Conference, organized and managed by the Central South Regional Electrical Power Transmission Automation Technology Information Network was held on 5-9 May 82 in Luoyang of Henan Province. Aside from members of the information network, 199 delegates representing 120 member units of the Southwest, Northwest, and East China Power Transmission Networks also attended. Among the topics discussed and exchanged at the conference, there were, the application of microcomputer in packaging and sorting machines of postal bureaus, using TRS-80 microcomputer to measure nuclear energy spectrum, microprocessor controlled direct current electrical machine speed regulating system, microprocessor and follower system, computer aided design: computing the internal force of a frame structure, a relatively powerful M6800 microcomputer system, application of Z-80 microcomputer for processing and analysis of electrically measured data of agricultural machines, laser multi-purpose welding machine microcomputer system, use of microcomputer in personnel file management, a simple and practical EPROM programmer, etc. SUN Bolin [1327 2672 2651] of Military Academy of Scientific Research was invited to report on his tour of observing the current condition of automation technology in Japan.

6168
CSO: 4009/388

AUTHOR: CHEN Shaofu [7115 1421 3940]

ORG: Automobile Manufacture Plant No 2

TITLE: "An Example of Designing a Machine Tool Used for Group Technology Machining"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 7, Jul 82 pp 28-30, 45

TEXT OF ENGLISH ABSTRACT: The basic consideration and step of designing a machine tool for group technology machining are realized and explained by an example of designing a program controlled machine tool with alterable transmission gear.

AUTHOR: HONG Shanliang [3163 6365 5328]

ORG: Correspondent of the Journal

TITLE: "High Precision Surface Grinder Model MG-7132"

SOURCE: Beijing JICHUANG [MACHINE TOOL] in Chinese No 7, Jul 82 pp 31-32

TEXT OF ENGLISH ABSTRACT: This article describes the structure characteristics of the main components such as the wheel head, the workable and the column, of the high precision grinder Model MG-7132 made by Hangzhou Machine Tool Plant. The feature of the machine tool is reliable and the operation is convenient. The unparallel accuracy of the ground surface is up to 0.005/1000 mm and the surface finish is ▽11 (> R 0.04 - 0.08 m.)

6248
CSO: 4009/383

AUTHOR: LUO Zhengming [5012 2973 2494]

ORG: Southwest Research Institute of Physics

TITLE: "The Method of the Magnetic Surface Ordinate for Solving the Equilibrium of Plasma Torus With a Non-circular Cross Section"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 369-378

TEXT OF ENGLISH ABSTRACT: In this paper, the G.J.W. theory of plasma equilibrium is used for solving the problem of equilibrium of a plasma torus with a non-circular cross section. In the case of quasi-uniform distribution of current density and small distortion of cross section, solutions of third order approximation both inside and outside of the plasma and the current distribution of the maintaining coils have been obtained. It is shown that, the effect due to the deformation of magnetic surface on the displacement of magnetic axis is small, on the other hand because of mode-mode coupling higher harmonic components appear in the external solution of plasma equilibrium. For example, the harmonic components with m = 4,5 can be found in the external solution of 3rd order approximation, although the distortion of cross section of plasma contains only components with mode m =1,2 (i.e. elliptical and triangular distortions.)

AUTHOR: ZHU Ruzeng [2612 1172 2582]

ORG: Research Institute of Dynamics, Chinese Academy of Sciences

TITLE: "Simplification of Transport Equations in a Gas Laser With Two Molecular Combined Levels"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 379-387

TEXT OF ENGLISH ABSTRACT: For gas lasers with two molecular combined levels (including flowing gas lasers) it is shown that if the diffusion is so fast that the spatial holes burned are washed out, the light intensity superposition principle can be used in the stimulated emission terms and stimulated absorption terms to give a pair of simplified equations. Applying the condition required for spatial holes burned to be washed out given by reference (7) it is shown that generally the light intensity superposition principle can always be used for CW gas lasers. Furthermore, we give the conditions required for the diffusion terms in the first simplified equations to be removed so that another pair of equations can be obtained. It is also pointed out that the diffusion terms in the transport equations can not be neglected if the field strength superposition principle is used.

AUTHOR: ZHONG Zhaoxin [6945 6856 2450]

ORG: China University of Science and Technology

TITLE: "Magnetostatic Equilibrium Configuration of Axisymmetric Magnetic Flux Tube"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 4, Jul 82 pp 404-409

TEXT OF ENGLISH ABSTRACT: In this paper by expansion of physical variables in terms of geometric parameters, the magnetostatic equilibrium configuration of an axisymmetric magnetic flux tube is discussed when the magnetic pressure, thermodynamic pressure, and gravity are taken into account. The magnetic flux tube is divided into a number of local regions and finite local solutions are obtained. Connecting local solutions covering the white region, using boundary condition of the magnetic flux tube and then determining the inner field by means of its connection with the outer field, we can obtain the entire solution of two-dimensional solar magnetic flux tube. On the basis of these solutions we discuss the influence of nonuniform temperature distribution in the magnetic flux tube on magnetic field strength, the magnetic configuration and the effect of twisted field lines when θ_0 is finite. The results are compared with those of reference (1). The results are used to explain magnetic configuration of equilibrium sunspot and energy required for solar flare explosion. The results agree basically with observation.

6248
CSO: 4009/384

AUTHOR: JIANG Zilong [5592 5261 7893]
HU Yuankun [5170 6678 0981]

ORG: None

TITLE: "Vibration of Cylindrical Structures in Nuclear Reactor System Induced by Axial Flow: A State-of-art Review"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 3, Aug 82 pp 11-18

ABSTRACT: Since the collapse of the Tacoma channel bridge in the USA in 1940, the problem of vibration induced by axial flow has attracted a great deal of attention. This problem exists in suspension bridges, tall and large smokestacks, tall buildings, power transmission structures, submerged telescopes of submarines, etc. and the problem is especially conspicuous in aviation and nuclear power industries as the high strength materials used in airplanes and nuclear reactor systems have made the structures thin and light in weight. Through a review of the conditions of current domestic and foreign research studies on the problem, this paper introduces excitation mechanism, mathematical models, equations demonstrating vibration amplitude, and the method of computing the frequency, discusses the influential factors, and proposes some problems for future research.

AUTHOR: None

ORG: None

TITLE: "The Second National Explosion Mechanics Conference"

SOURCE: Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 3, Aug 82 pp 75-76

ABSTRACT: The Second National Explosion Mechanics Conference, under the auspices of the China Society of Mechanics, was held in Yangzhou City in Dec 81. Participants included 260 delegates representing 84 organizations. The major contents of discussion of this conference included the 6 aspects of explosion effect, technique of quantitative measurement of explosion, dynamic characteristics of materials, anti-explosion structures, explosive bombardment, and explosion computation mechanics. Specialists reflected at the conference that there has not been sufficient research on submerged explosion and a great deal of work is still needed to study problems of the effect of faults, transmission of waves in saturated or moist soil, hydrogen bomb equipment, the principle of fragments formation, etc. There has not been sufficient study on charge induced explosions. There is also insufficient coordination between computation work and experimental work; the two are separated in such a manner that the advancement of knowledge of the researchers is affected and the results of their research are unavoidably limited.
6168
CSO: 4009/390

AUTHOR: None

ORG: None

TITLE: "Alloy Steel Conference Held in Beijing"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 pp 73-74

ABSTRACT: For the purpose of promoting the development of alloy steel, adjusting the product structure, and orienting the direction of service, the National Planning Committee, Economic Committee, and Science Committee, and the Ministry of Metallurgy called an Alloy Steel Conference in Beijing in the early and middle parts of Apr. More than 220 persons, representing the national departments of planning, economics, finance, and the production, research, and application units of alloy steel and low alloy steel, as well as some specialists attended. The deputy minister of the Ministry of Metallurgy, LU Da [7120 6671] reported the current condition of production of alloy steel and low alloy steel in China and proposed some preliminary plans of development in the 6th 5-year plan. Representatives of several ministries introduced the condition of uses of alloy steel and future needs for its development. Problems of product standards, prices, serialization, and the policy of using alloy elements were discussed as special subjects. Representatives of such industrial departments as machinery, petroleum, light industry, electronics, etc. emphasized the importance of good quality and inexpensive products for establishing the idea of service to the customers

AUTHOR: None

ORG: None

TITLE: "The 4th Standing Council Meeting of the China Society of Metals Was Held"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 pp 74-75

ABSTRACT: The 3rd meeting of the 4th Standing Council of the China Society of Metals was held in Beijing, 27-28 Apr 82. Participants included 27 members of the Standing Council. Major contents of the meeting included the following: (1) The work of China Society of Metals in 1981 was summarized; important items of work in 1982 were discussed. At present the Society has about 44,000 members. In 1981, 65 domestic scientific discussion meetings were held and representatives were sent to participate in 25 international meetings. The financial accounts of 1981 and the financial budget of 1982 were approved. (2) The addition of a continuous ingot casting committee was decided upon in order to promote the technique, and production development of ingot casting. It was also decided that there should be no metallurgical documentation filing committee. Instead, the China Archives Society should be asked to establish a branch of metallurgical archives. (3) Suggestions concerning the 4th National Congress of Representatives of the China Society of Metals and the concurrent Scientific Conference were discussed.

AUTHOR: YU Zhaokun [0827 5128 0981]

ORG: None

TITLE: "Scientific Symposium on High Strength Low Alloy Steels"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 7, Jul 82 p 78

ABSTRACT: China Society of Metals Special Steel Committee and the Iron and Steel Company of the Ministry of Metallurgy called a scientific symposium on high strength and low alloy steels in Wugang, 22-26 Dec 81. Previously, symposiums on high strength steel, low temperature steel, atmosphere-resistant and sea-water corrosion tolerant steel, and low alloy corrosion tolerant steel had been convened. Participants of this symposium included 165 persons representing 70 research, production, designing, manufacturing, applications, and eduational institutions; 144 papers were delivered. Among these papers, aspects of materials research, quality improvement, metal phase change mechanism, fracture toughness, brittleness and corrosion mechanism, method of testing, welding, engineering structures were covered. It was pointed out at the symposium that judging from the prospect of development,at present and for a long time to come, of industries, in energy resources, of the sea, of transportation, and construction, a large quantity of low alloy high strength steel will be required. In order to guarantee the safe application of large size welded steel structures manufactured in China, continued research on problems of production, manufacture, and application in the future is urgently needed.

6168
CSO: 4009/385

AUTHOR: None

ORG: None

TITLE: "A Prototype of the SBYB-465K Dual Pump Hydraulic Power Torque Converter Successfully Made"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 24

ABSTRACT: A Fruit of Research Stage Technological Certification Conference was held in Beijing in the middle of June to inspect the prototype of the SBYB-465K dual pump hydraulic power torque converter, which has been the product of joint research of Changsha Mining Research Academy, Shenyang Mining Machinery Plant, and Beijing Industrial College. From 1979 to 1981, the 3 research organizations started the project with nothing but a photograph to produce, finally, this prototype in these 3 short years after overcoming many difficulties. The model machine completed test operations on the 400 kw hydraulic power testing bench for a duration of more than 400 hours and 15,000 data were obtained from the test to prove that the research project of making the instrument has been successful. These data also provide reliable bases for continuous research in the future.

AUTHOR: WANG Feng [3769 1496]
GAO Shunhua [7559 7311 5478]

ORG: None

TITLE: "The DD2056 Single Shaft Vibrating Sifter Certification Conference Held in Kailuan"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 30

ABSTRACT: The DD2056 single shaft vibrating sifter certification conference was held in Fangezhuang Mine of Kailuan Bureau of Mines in the middle of Jun 82. The delegates listened to the reports on its designing, testing, industrial experimentation, and the condition of use by the Luoyang Research Institute of Mining Machines, the Pingdingshan Coal Washing Design Academy, the Huaibei Mining Machine Plant, the Fangezhuang Mine, and the Matou Electrical Plant. The delegates also observed the condition of empty runs and loaded operations of the machine and inspected the technical documentation of the product. They agreed that it is presently China's largest coal grading sifter of high efficiency and simple structure. Its successful research resolved the problem of the urgent needs of grading equipment in China's large and medium coal washing plants. The conference issued a certificate of approval to have it manufactured in batches.

AUTHOR: WU Jianhua [0702 0256 5478]

ORG: None

TITLE: "Chongqing Mining Machinery Plant Successfully Made a New Pneumatic Prop Drawing Winch"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 35

ABSTRACT: In order to meet the needs of the coal industry, the Chongqing Mining Machinery Plant most recently produced the JHF-10 pneumatic prop drawing winch suitable to work under the dangerous condition of coal dust and gas filled pits. It is not operated on electrical power source; therefore, there is no possibility of starting a gas explosion by sparks. It is driven by compressed air instead. It is made of a high strength aluminum alloy and weighs only 80 kg. The sample machine has undergone industrial tests at several pits and won the approval of the users. The certification conference of the winch was held in Chongqing Mining Machinery Plant in the middle of Jun 1982. The delegates of the conference agreed for it to be manufactured in batches.

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ORG: None

TITLE: "Trade Quality Inspection of the JD-11.4 Dispatching Winch"

SOURCE: Luoyang KUANGSHAN JIXIE [MINING MACHINERY] in Chinese No 7, Jul 82 p 58

ABSTRACT: During the Huainan Trade Conference in Mar 82, the Mine Pit Hoist and Winch Specialty Group of the Mining Machinery Trade of the Ministry of Machines resolved to carry out a trade quality inspection of the JD011.4 dispatching winches made by the Shanghai Dongfeng Machinery Plant, the Huainan Coal Mine Machinery Plant, and the Xuzhou Mining Equipment Manufacturing Plant. The results of the inspection indicate that the noise and cleanliness levels of the winches of all three plants are lower than the quality regulation requirement. The concrete test results are as follows: The noise of the winch of Shanghai Dongfeng Machinery Plant is 82.25db, thecleanliness 554 mg; the noise of the winch of Huainan Coal Machinery Plant is 76.9 db, and cleanliness is 71.7 mg; the noise of the winch of Xuzhou Mining Equipment Manufacturing Plant is 76 db, the cleanliness 40.1 mg. All major properties are up to the regulation requirements.

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